

EarthSaw™ *In Situ* Containment of Pits and Trenches

Technology Need:

Containment technologies, such as caps and vertical barrier walls, are widely used to confine and control subsurface contamination from unlined disposal pits and trenches. Many effective alternatives exist for capping waste areas and for installing vertical barrier walls around waste areas, but there has been no way to install a bottom barrier below a waste while the waste remains in place.

Department of Energy (DOE) environmental managers are tasked with remediation of unlined pits and trenches where a variety of wastes, including hazardous and radioactive materials, are buried. “Dig and Haul” remediation is a common method for addressing these areas. This option is effective, but risks exposing workers and the public to the unearthed material. Containing the waste using caps and/or subsurface barrier walls is an attractive alternative because the waste is not disturbed and potential exposure pathways are minimized. An effective method is needed to install a bottom barrier below a waste area to provide complete containment of waste left in place.

Technology Description:

The EarthSaw™ buoyant barrier process, developed by Carter Technologies Co., makes it feasible to construct a thick and impermeable bottom barrier under a contaminated landfill area without disturbing the waste. The process works by mechanically slicing a horizontal cut through the earth while allowing a high-density grout to gravity flow into the cut. The high-density grout is more dense than the earth and causes the severed block of earth to become buoyant. Additional grout gravity flows into the cut, increasing the final thickness of the bottom layer. The waste area is completely surrounded by the grout to form a containment barrier. A synthetic cap may be added to

form a complete vault structure with passive leak detection by differential air pressure and humidity.

Carter Technologies has demonstrated the EarthSaw™ technology on a small-scale at an industrial site in Texas. During the demonstration, the EarthSaw™ buoyant barrier process was used to float and contain an 10 ft. by 10 ft. by 8 ft. deep block of earth. The non-hardening grout used for this demonstration had an initial permeability of 1×10^{-6} cm/s and a permeability of 1×10^{-8} cm/s after 6 months of curing.

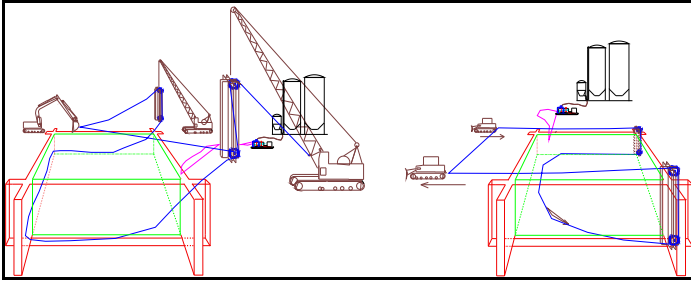


Small-scale demonstration of EarthSaw™

The EarthSaw™ Vertical Block method has five steps:

- ▶ A conventional bentonite slurry trench is excavated around the contaminated area.
- ▶ The cutting cable is threaded through a load frame and lowered into the trench.
- ▶ The high density fluid grout is prepared and pumped to the bottom of the slurry trench to displace the light weight bentonite slurry.
- ▶ The cutting cable is reciprocated and drawn underneath the contaminated block of earth, pulled by a pair of bulldozers or winches.

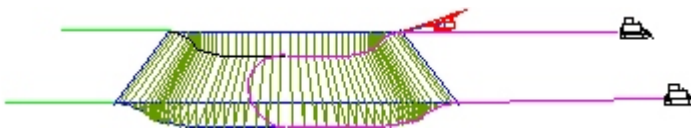
- ▶When the cut is complete, the severed block of earth floats on the dense grout. Additional grout poured into the trench buoyantly raises the block to achieve the desired barrier thickness under the block.



Installing the load frame and cable and making the bottom horizontal cut.

The EarthSaw™ can also be deployed using a horizontal directional drilling (HDD) method as depicted in the figure below. This method uses a similar cutting cable to cut a horizontal pathway between horizontal directionally drilled holes instead of vertical trenches.

Proprietary impermeable grouts available for use in this process come in several varieties:



HDD method cuts between horizontal boreholes.

- ▶TECT A grouts develop high structural strength and are resistant to solvents, salts and biological attack.
- ▶Non-Hardening TECT B grouts mimic low permeability clay, remaining soft and pliable in moist underground environments.
- ▶TECT W grout is molten liquid that solidifies to form a malleable, waxy solid which can bend and deform with earth movement even under totally dry conditions.

Benefits:

- ▶Completely contains waste in place.
- ▶Containing waste in place minimizes the potential for exposure to contaminants during construction.

- ▶Applicable to many subsurface conditions.
- ▶Grout properties can be tailored to subsurface conditions.
- ▶Barrier continuity and integrity are verifiable.

Status and Accomplishments:

Carter Technologies has provided a narrative description and engineering derivations to support the theoretical basis of the EarthSaw technology. Carter Technologies has also completed modeling in an attempt to predict the effectiveness of the EarthSaw technology for a variety of simulated waste area conditions. A controlled field test plan for a 50 ft. by 50 ft. by 20-30 ft. deep demonstration has been prepared. The controlled field test will include an engineering analysis of the constructability and functional performance of the barrier as well as a life cycle cost and performance analysis. The controlled field test, if approved by DOE, would be conducted at a DOE or representative private site.

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Online Resources:

Office of Science and Technology, Technology Management System (TMS), Tech ID # 3155
<http://ost.em.doe.gov/tms>

The National Energy Technology Laboratory Internet address is <http://www.netl.doe.gov>